WHAT IS CLAIMED IS:

Claim 1. An angular position sensing apparatus for mounting on a rotatable body having a center of rotation and for determining an angular position of the rotatable body relative to a point in space comprising:

a first dual-axis accelerometer having a first sensing axis for sensing a first acceleration component and a second sensing axis for sensing a second acceleration component, wherein the first and second sensing axes are in substantially perpendicular relation, the first dual-axis accelerometer operable to output a first signal proportional to the sensed first acceleration component and to output a second signal proportional to the sensed second acceleration component,

a second dual-axis accelerometer having a third sensing axis for sensing a third acceleration component and a fourth sensing axis for sensing a fourth acceleration component, wherein the third and fourth sensing axes are in substantially perpendicular relation, the second dual-axis accelerometer operable to output a third signal proportional to the sensed third acceleration component and to output a fourth signal proportional to the sensed fourth acceleration component, the first and second dual-axis accelerometers being mounted in spaced apart relation on a printed circuit board defining a plane of reference and for being mounted on the rotatable body spaced apart from the center of rotation, and

a microprocessor operable to determine the angular position of the body as the body rotates through a plurality of angular positions by selecting a fifth signal dependent on the first and third signals or a sixth signal dependent on the second and fourth signals and determining the angular position of the rotatable body therefrom.

Claim 2. The angular position sensing apparatus of Claim 1 wherein the microprocessor determines the fifth signal by subtracting the first signal provided by the first dual-axis accelerometer from the third signal provided by the second dual-axis accelerometer and a sixth signal by subtracting the second signal provided by the first dual-axis accelerometer from the fourth signal provided by the second dual-axis accelerometer.

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Claim 3. The angular position sensing apparatus of Claim 2 wherein the first, third and fifth signals correspond to acceleration components that are substantially radial with respect to the point in space and the second, fourth and sixth signals correspond to acceleration components that are substantially tangential to a circle having a center point that is proximate to the point in space, the angular position sensing apparatus thereby being operable to substantially nullify angular acceleration and centrifugal acceleration errors by using the fifth and sixth signals to determine angular position.

Claim 4. The angular position sensing apparatus of Claim 1 wherein the microprocessor further comprises a finite impulse response filter having filter response coefficients for processing the fifth and sixth signals by averaging a power associated with the fifth and sixth signal over the filter response coefficients.

Claim 5. The angular position sensing apparatus of Claim 4 wherein the finite impulse response filter includes a sampling frequency of about 300 Hz, a passband frequency of about 2 Hz, and a stopband frequency of about 8 Hz.

Claim 6. The angular position sensing apparatus of Claim 1 wherein the fifth signal corresponds to a first sine wave function and the sixth signal corresponds to a second sine wave function ninety degrees out of phase with respect to the first sine wave function.

Claim 7. The angular position sensing apparatus of Claim 6 wherein the microprocessor determines the angular position of the body by determining which of the fifth and sixth signals has the highest resolution and having the signal having the highest resolution to determine the angular position of the body.

Claim 8. The angular position sensing apparatus of Claim 1, wherein a first line extended from the first sensing axis of the first dual axis accelerometer intersects a second line extended from the third sensing axis of the second dual axis at a point proximate to the center of rotation of the angular position sensing apparatus.

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Claim 9. The angular position sensing apparatus of Claim 1 wherein the microprocessor further comprises a noise spike filter, operable to compare the first, second, third and fourth signals to an average of two preceding signals and two subsequent signals corresponding to each of the first, second, third and fourth signals, thereby classifying a signal as noise spike if the comparison is greater than a predetermined number.

Claim 10. The angular position sensing apparatus of Claim 1, wherein the microprocessor further comprises an angle processing module for determining a current head quadrant location and determining the angular position of the sensor head based in part on the quadrant location.

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Claim 11. In an alignment system for aligning a centerline of a first shaft with a centerline of a second shaft, the shaft alignment system including an analyzer having memory, a mounting bracket having engagement surfaces for engaging the first shaft and securing the bracket to the first shaft, a sensor head having a facing surface and a rear surface in opposing relation disposed on the mounting bracket and extending in a substantially perpendicular orientation with respect to the centerline of the first shaft, a collimated light source mounted on the sensor head for transmitting a beam of energy in a direction that is substantially parallel to the first shaft, and a photosensitive sensor mounted on the sensor head for sensing light and generating a position signal corresponding to a position of a light beam impinging upon the photosensitive sensor, an angular position sensing apparatus comprising:

at least one accelerometer for generating a signal corresponding to the angular orientation of the sensor head with respect to the first shaft, and

a microprocessor for processing the angular position sensor signal generated by the angular position sensor, operable to provide an output corresponding to the angular position of the sensor head relative to the first shaft.

Claim 12. The angular position sensing apparatus of Claim 11, wherein the microprocessor further comprises an angle processing module for determining a current head quadrant location and determining the angular position of the sensor head based in part on the quadrant location.

Claim 13. The angular position sensing apparatus of Claim 11, wherein the accelerometer is a single-axis accelerometer for generating a signal proportional to the angular orientation of the sensor head.

Claim 14. The angular position sensing apparatus of Claim 11, wherein the accelerometer is a dual-axis accelerometer having a radial and a tangential axis, for generating radial and tangential signals proportional to the angular orientation of the sensor head.

Claim 15. The angular position sensing apparatus of Claim 11 further comprising:

a first dual-axis accelerometer having a first sensing axis for sensing a first acceleration component and a second sensing axis for sensing a second acceleration component, wherein the first and second sensing axes are in substantially perpendicular relation, the first dual-axis accelerometer operable to output a first signal proportional to the sensed first acceleration component and to output a second signal proportional to the sensed second acceleration component, and,

a second dual-axis accelerometer having a third sensing axis for sensing a third acceleration component and a fourth sensing axis for sensing a fourth acceleration component, wherein the third and fourth sensing axes are in substantially perpendicular relation, the second dual-axis accelerometer operable to output a third signal proportional to the sensed third acceleration component and to output a fourth signal proportional to the sensed fourth acceleration component, the first and second dual-axis accelerometers mounted in spaced apart relation defining a plane of reference.

Claim 16. The apparatus of Claim 15, wherein the microprocessor is operable to determine the angular position of the sensor head as the sensor head rotates through a plurality of angular positions about the first shaft by selecting a fifth signal dependent on the first and third signals or a sixth signal dependent on the second and fourth signals and determining the angular position of the rotatable body therefrom.

Claim 17. The angular position sensing apparatus of Claim 16 wherein the fifth signal corresponds to a first sine wave function and the sixth signal corresponds to a second sine wave function ninety degrees out of phase with respect to the first sine wave function, wherein the microprocessor determines the angular position of the body based on the most linear region of the first or second sine waves.

Claim 18. An angular position sensing apparatus for sensing the angular position of the apparatus as it is rotated about a point of rotation, comprising:

a housing disposed for rotation about a point,

first and second dual axis accelerometers disposed on the housing in a side-by-side, spaced apart relationship,

the first dual axis accelerometer having a radial axis accelerometer for producing a signal corresponding to acceleration along a first radial axis and a tangential axis accelerometer for producing a signal corresponding to acceleration along a first tangential axis,

the second dual axis accelerometer having a radial axis accelerometer for producing a signal corresponding to acceleration along a second radial axis and a tangential axis accelerometer for producing a signal corresponding to acceleration along a second tangential axis,

the first and second dual axis accelerometers being disposed to place the first and second radial axis on lines that intersect at an intersection point, and

a processor for receiving the signals from the first and second dual axis accelerometers and for producing a signal corresponding to the angular position of the housing.

Claim 19. The apparatus of Claim 18 wherein the processor is further operable to mathematically process the signals from the first and second dual axis accelerometers to correct for the effects of centrifugal acceleration and angular acceleration on the accelerometers as they rotate about the point.

Claim 20. The apparatus of Claim 18 wherein the processor is further operable to subtract the first radial and tangential signals from the second radial and tangential signals, respectively, to correct for the effects of centrifugal acceleration and angular acceleration on the accelerometers as they rotate about the point.

Claim 21. The apparatus of Claim 18 wherein said intersection point is disposed proximate said point of rotation.

Claim 22. The apparatus of Claim 18 wherein said processor is programmed to receive point position data corresponding to the position of the intersection point relative to the point of rotation and to correct the angular position signal based upon the point position data.